

Protocol Development Summary
River Monitoring Program
July 18, 2005

Protocol: Protocol to Monitor Fish Communities, Physical Habitat, and Macroinvertebrates in Rivers of National Parks in the North Coast and Cascades Network (Rivers Protocol).

Parks Where Protocol Will Be Implemented: The protocol will primarily be implemented in OLYM. We also intend to implement the protocol in MORA and NOCA.

Justification: Rivers that drain from Olympic and Mount Rainier National Parks (OLYM and MORA) represent some of the last remaining undisturbed, contiguous aquatic habitat throughout the range of several west coast fish species. Fish assemblages that inhabit these rivers represent critical components of biological integrity from ecosystem and public interest perspectives. Fish communities were ranked *third* among all potential vital signs to monitor in the North Coast and Cascades Network (NCCN). Fish species also serve as excellent indicators of ecological conditions based on their longevity, ability to forage at different trophic levels, and relative ease of identification (Plafkin et al. 1989).

OLYM supports 29 species of Pacific salmon, trout, char, and other non-salmonids. OLYM is the only national park in the lower 48 states that contains significant numbers of Pacific salmonids. Pacific salmon are critical to ecosystem function in western North America, and link freshwater, marine, and terrestrial ecosystems. Pacific salmonids provide food for over 130 species of aquatic and terrestrial wildlife species (Cederholm et al. 2001). Recent studies have shown that 20 to 40% of the phosphorus, nitrogen, and carbon in freshwater systems may be marine-derived through carcasses of spawned salmon (Kline et al 1990, 1994; Bilby et al. 1996).

The decline of wild salmonids in the Pacific Northwest is a significant regional environmental concern. Substantial declines in distribution and abundance of Pacific Northwest wild salmonids have been attributed to overharvest in recreational and commercial fisheries, displacement by non-native fish species, hatcheries, dams, ocean conditions, and habitat degradation (Natural Resource Council 1996; Emmett, R. L. and M. H. Schiewe 1997; Francis 1997). In the NCCN, a total of three fish species are considered threatened under the Endangered Species Act including Puget Sound chinook, Puget Sound/Coastal bull trout, and Ozette sockeye salmon. There are several potential threats to the persistence of native fish species in the NCCN including direct recreational and commercial harvest that occurs in the lower portions of many park rivers. Ultimately, these fisheries influence the number of fish that return to waters in National Parks. An understanding of reference conditions and trends in fish populations will be essential to the development of appropriate management and conservation strategies in the NCCN.

Macroinvertebrate assemblages in lotic systems reflect overall biological integrity of the benthic community, and monitoring these assemblages provides information on trends in ecological condition of rivers (Peck et al. 2003). Benthic macroinvertebrates are commonly used as rapid and reliable indicators of aquatic ecosystem health and function. In this protocol, we adapt established macroinvertebrate sampling protocols initiated by North Cascades National Park (NOCA) and apply and further test these methods at OLYM. Additionally, information will be collected on physical habitat variables that will be used to help explain or diagnose river conditions relative to other biological vital signs.

Monitoring Questions and Objectives:

The primary goal is to establish baseline natural variability and detect trends in selected vital sign indicators of biological and physical attributes of rivers in the NCCN. The monitoring will be designed to provide important information to park management and determine overall condition and health of rivers.

General Monitoring Questions:

- 1) Are fish communities that inhabit rivers changing in relative abundance, species composition, and age structure?

Fish : Seasonal relative abundance, frequency of occupancy, size and age structure, species composition, and extent of hatchery and non-native fish. Other specific indicators may be identified by USGS and NPS during the development of protocols for large rivers.

- 2) Are macroinvertebrate communities that inhabit rivers being impacted by anthropogenic stressors?

Macroinvertebrates: Species richness, functional feeding groups, and taxa ratios.

- 3) Are there changes in physical habitats in reference reaches of rivers?

Indicators: Specific indicators and metrics will be identified and developed by USGS and NPS River Monitoring Program. Important indicators may include but are not limited to: water temperature, woody debris, river width, habitat types (e.g. pools, riffles, etc.), and riparian conditions.

Basic Approach:

Monitoring protocols designed to detect changes in biological and physical attributes of non-wadeable streams have been established and accepted throughout the Pacific Northwest (Peck et al. 2003). In this protocol, we intend to rely on existing protocols for the sampling of macroinvertebrate communities. However, we believe that existing sampling protocols for fish communities in the EPA protocol are inadequate for rivers in the NCCN based on logistical constraints, poor accessibility, and concerns related to repeated boat electrofishing in park waters where adult salmonids and federally threatened fish species occur.

Protocol development and sampling design will primarily focus on fish communities, particularly because of the importance of fish to ecosystem processes and high ranking as a vital sign within the NCCN. The development of the protocol will be confined to OLYM in fiscal years 2004 and 2005 based on anticipated budget constraints. The general approach is to frequently sample five km reference reaches of rivers immediately upstream from the park boundary and provide a network of sampling sites to detect biologically significant change over time. For the purposes of the development of this protocol, the working definition of a river is a system that is non-wadeable (e.g., > 30 m wetted width and most pools >2 m depth) during winter months. A total of 11 non-wadeable rivers occur in OLYM, 9 in MORA, and 2 in NOCA. However, the actual network of river monitoring sites will be limited to those rivers where snorkeling and/or backpack electrofishing methods may be employed during summer months. A possible rotating panel design for measuring biological and physical attributes of rivers at OLYM is outlined in Table 1. We also intend to sample the Ohanapecosh and White Rivers in MORA and the Stehekin River at NOCA (Table 2).

Fish: Fish communities in rivers will be frequently monitored throughout a year using day snorkeling and backpack electrofishing. Methods will be used to assess community composition, relative abundance, frequency of occupancy, timing of migration, age/size structure, and extent of native, non-native, and hatchery fish.

Physical Habitat: The sampling of physical habitat will be designed to provide quantitative descriptions of reach scale habitat variables in a limited amount of time. On an annual basis with appropriate funding, we anticipate using a two-level hierarchical habitat classification system that is a modified system described by Hawkins et al. (1993) on each sampled reach. The first level classification will identify the channel type as main channel, braided channel, side channel, overflow channel, slough, and tributary mouths. The second level defines the various habitat units (pool types, riffles, glides, etc.) of the channel and we will measure habitat length, width, and maximum and average depth.

Macroinvertebrates: The sampling of macroinvertebrate communities will be established using protocols initiated by NOCA. We intend to apply and further test these methods in non-wadeable rivers in OLYM. Specifically, we will collect baseline data in five km reference reaches and establish future monitoring sites. NOCA staff collected macroinvertebrate samples from 166 wadeable streams. The work included stratification, reference site selection, sampling, laboratory procedures, QA/QC protocols, and multivariate and multimetric analyses. With appropriate funding, we will apply the macroinvertebrate protocols to each selected river. Alternatively, we will rely on the Wadeable Stream program to detect change in macroinvertebrate communities

Table 1. A possible rotating panel design for monitoring rivers at OLYM. Ultimately, the rivers should be chosen randomly or systematically based on strata and allocation factors, but they are listed here in alphabetical order simply for convenience. The panel also should include the White and Ohanapecosh Rivers in MORA (2-3 annual visits) and Stehekin River at NOCA (3 annual visits).

OLYMPIC NATIONAL PARK	Year 1	Year 2	Year 3	Year 4
Bogachiel a,c	X	X	X	X
Calawah c	X	X	X	X
Dosewallips a,c	X	X	X	X
Greywolf a,c	X			
Elwha b,c	X			
Hoh b,c		X		
N. Fk. Skokomish a,c		X		
Ozette b,c			X	
Sol Duc a,c			X	
Queets b,c				X
Quinault a,c				X

- a. Snorkeling possible from June thru October
- b. Snorkeling limited to ~one month during summer
- c. Backpack electrofishing possible in river margins from May thru October

NCCN Science Panel Recommendations to River Monitoring Protocol in

May, 2005: The NCCN Science Panel had the following comments: 1) the network should also sample the Stehekin river at NOCA; and 2) co-location of physical, chemical and biological vital signs is good. The recommendations by the Science Panel do not change the existing objectives, methodologies, or sampling design.

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Development Schedule, Budget, and Expected Interim Products: The protocol will be written by NPS and USGS after two years of pilot field work. Products associated with protocol development include: 1) a contract with a statistician to design the sampling frame; 2) a peer reviewed study plan and final protocol that outlines monitoring objectives, sampling design, power to detect trend and methods for monitoring fish communities in large rivers in the NCCN; 3) peer review of the final protocol by at least three USGS fisheries scientists involved in the monitoring of fish communities; 4) establishment of long term monitoring sites in OLYM; and 5) establishment of long term monitoring sites in the Stehekin River, NOCA and White and Ohanapcosh Rivers, MORA. The protocol will meet NPS standards and will be developed in accordance with Oakley et al. (2003). The goal is to implement the protocol in OLYM rivers, (2) MORA rivers, and (1) NOCA river in June, 2007.

Table 2. Annual itemized costs of personnel, equipment, vehicles, and contributed funds to monitor fish communities in rivers based on FY 05 monies. Distribution of budget as follows: NOCA=\$2,300 (3 annual visits); MORA=\$6,850 (2-3 annual visits); and OLYM=\$21,650 (number of visits to be determined based on pilot work and statistical contract).

River Monitoring Program OLYM and MORA	NCCN Funds	Contributed	
		OLYM Base Funds	OLYM GIS Staff
Program supervision, administration, data analysis, and reporting Fisheries Biologist, GS 12-01, 5 pp		16,375	
Fishery technician, GS 06, Term, 9 pp, OLYM	14,850		
Seasonal Fisheries Technician, GS 05, 9 pp, OLYM	10,746		
GIS support, GS 9, 1pp, OLYM			2,000
Equipment and supplies	2,000	3,000	
Vehicle		1,850	
Travel and Per Diem	904		
Sub Total	28,500	21,225	2,000
NOCA, Stehekin River	NCCN Funds	NOCA Base Funds	NCCN Fixed Cost
GS-12 Aquatic Ecologist -Program supervision, administration (.5 pp)		1,788	
GS-11 Aquatic Ecol – field supervision, data collection, analysis and reporting (1.5 pp)			3,906
GS-6 Bio Tech (2 people x 1pp each)	1300	1,300	
Travel (vehicles, ferry, per diem)	500		
Msc Equipment	500		
Sub Total	2,300	3,088	3,906
Total	30,800	24,313	5,906

OLYM positions based on GS 06-03, term, \$1,650/pp @ 33% benefits; GS 5, seasonal, \$1,194/pp @ 7.6% benefits 7.6%

Table 3. Projected implementation schedule for River Monitoring Program.

Month	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15
Hiring					X	X																		
Training									X															
Data collection					X	X	X	X	X	X	X	X	X	X	X	X	X	X						
Data entry														X	X	X	X							
QA/QC														X	X	X	X							
Reporting																			X	X				

X=OLYM rivers using OLYM crew. OLYM crew responsible for data collection, analysis, and reporting

X=White and Ohanapecosh Rivers using OLYM crew (2-3 annual visits)

X=Stehekin River using NOCA crew (3 annual visits). NOCA crew responsible for data collection, analysis, and reporting

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